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PROJECT APOLLO
END ITEM SPECIFICATION
BOILERPLATE NUMBER 13 (U)

22 January 1964 NAS9-150

Paragraph 4.2, Exhibit I.

CLASSIFICATION CHANGE

To UNCLASSIFIED
By authority of GDS-EO 11652 GP-4 Date 12/31/72
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This document contains information affecting the national [redacted] U.S.C. Section [redacted] its contents in any manner to an [redacted]

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION

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1. SCOPE

1.1 Scope. - This specification defines the requirements for a simulated Apollo Spacecraft consisting of a Launch Escape System (LES), Command Module (CM), Service Module (SM) with insert, and SM/S-IV Adapter, hereinafter referred to as Boilerplate Number 13.

1.1.1 Specification Organization. - This specification is organized as follows:

Basic Section
Appendix A - Drawings
Appendix B - Process Specifications
Appendix C - Material Specifications
Appendix D - Procurement Specifications
Appendix E - Flight Hardware

1.1.2 Mission. - The mission of Boilerplate Number 13 is to determine the space vehicle launch exit environment.

1.1.3 Objectives. - The test objectives of the mission are as follows:

(a) First-Order Test Objectives

1. Demonstrate the physical compatibility of the launch vehicle and boilerplate spacecraft under pre-flight conditions.

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2. Determine the launch and exit environmental parameters to verify design criteria.

(b) Second-Order Test Objectives

1. Demonstrate the structural integrity of the launch escape system under flight loading conditions.
2. Demonstrate satisfactory launch escape tower jettison.
3. Demonstrate the compatibility of the R & D communications and instrumentation system with the launch vehicle systems.

2. APPLICABLE DOCUMENTS

2.1 Applicability. - Unless otherwise specified the following documents of the issue in effect on the date of contract form a part of this specification to the extent specified herein.

2.1.1 Government Documents.

SPECIFICATIONS

Military

MIL-E-5400	Electronic Equipment Aircraft, General Specification for

MIL-I-8500	Interchangeability and Replaceability of Component Parts for Aircraft and Missiles, Specification for
MIL-L-6880	Lubricating Aircraft, General Specification for
MIL-R-27542	Reliability Program Requirements for Systems, Subsystems, and Equipment Specification for

STANDARDS

MIL-STD-130	Identification Marking of U.S. Military Property

PUBLICATIONS

National Aeronautics and Space Administration (NASA)

NPC 200-2	Quality Assurance Provisions for Space Contractors, dated 20 April 1963

2.1.2 Non Government Documents.

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SPECIFICATIONS

North American Aviation, Inc., Space and Information Systems Division (NAA/S&ID)

MA 0116-012	Preparation for Delivery and Transport of Apollo Boilerplates, Specification for
MA 0201-0208	Identification and Traceability, Internal Apollo Program, Specification for
MC 999-0002	Electromagnetic Interference Control for the Apollo Space System, Specification for

OTHER DOCUMENTS

SID 62-109	General Test Plan, Research and Development for Project Apollo Spacecraft
SID 63-143-8	Actual Weight and Balance Report Boilerplate No. 13
SID 62-223	Apollo Program Plan

SID 63-313	Apollo Master Spacecraft Specification
SID 63-563	Apollo Measurement Requirements Boilerplate 13
SID 63-941	Performance and Interface Specification for Boilerplate Number 13
SID 62-1001	Preliminary Flight Research and Development Instrumentation, Interface Requirements Specification for

DRAWINGS

North American Aviation, Inc., Space and Information Systems Division (NAA/S&ID)

B14-000002-171	General Assembly, Apollo Complete Boilerplate 13
B14-000024	Finish Specification, Apollo Boilerplate, Complete

B16-000002-211	General Assembly, Command Module 13
B17-000002-131	General Assembly, Service Module

2.2 Precedence. - The order of precedence in case of conflict will be as follows:

(a) The contract

(b) This specification

(c) Other documents referenced herein.

3. REQUIREMENTS

3.1 General. - The following paragraphs delineate the basic requirements for design, fabrication, assembly, and performance for Boilerplate Number 13. Systems and subsystems development plan philosophy is reflected in SID 62-223, Apollo Program Plan.

3.1.1 Weight. - Weight, center of gravity, and moments of inertia data shall be as presented in SID 63-143-8.

3.2.1 Materials. - Materials, parts, and processes shall be in accordance with Specification SID 63-313.

3.1.2.1 Fabrication. - Structural design concepts of Boilerplate Number 13 emphasize employment of proven manufacturing techniques and methods to the greatest possible extent. Maximum use shall be made of developed "off-the-shelf" components fabricated by dependable manufacturers.

3.1.3 Design Criteria. - Design criteria shall be in accordance with rational design principles as specified in Specification SID 63-313.

3.1.3.1 Electromagnetic Interference. - Electromagnetic interference control shall be in accordance with SID Specification MC 999-0002.

3.1.3.2 Environment. - The environmental design criteria for Boilerplate Number 13 shall be as specified in Specification SID 63-313.

3.1.3.3 Checkout Provisions. - Boilerplate Number 13 shall be designed with provisions for system and integrated systems checkout and test capabilities.

3.1.4 Interchangeability. - Interchangeability as defined for the Apollo Program shall be in accordance with Specification MIL-I-8500 and shall apply to all completely finished assemblies, components, and parts which shall be capable of being readily installed, removed, or replaced without alteration, misalignment, or damage to parts being installed or to adjoining parts. No fabrication operations, such as cutting, filing, drilling, reaming, hammering, bending, prying, or forcing, shall be required for installation.

3.1.4.1 Interchangeability of Electronic Equipment. - Interchangeability of electronic equipment shall be in accordance with Specification MIL-E-5400, where applicable. Interchangeability of electronic equipment for the Apollo Program shall require that mechanical and electrical interchangeability shall exist between like assemblies, sub-assemblies, and parts regardless of the manufacturer or supplier. Interchangeability for the purpose of the Apollo Program, does not mean identity, but shall require that a substitution of such like assemblies, sub-assemblies, and replaceable parts be easily effected without physical or electrical modification to any part of the equipment, including, cabling, wiring, and mounting and without resorting to selection; however, adjustment, trimming, or calibration may be made.

3.1.5 Replaceability. - Replaceability, as defined for the Apollo Program, shall be in accordance with Specification MIL-I-8500 and shall apply to parts which may require additional work or operations during installation. This may include such additional operations as drilling, reaming, cutting, filing, trimming, shimming, or other means, normally associated with installing the original assembly into the end item. Replaceable parts shall be designed to permit replacement under field maintenance conditions.

3.1.6 Finish. - Finish requirements shall be as specified in SID Drawing B14-000024.

3.1.7 Identification and Marking. - Identification and marking shall be in accordance with Specification MIL-STD-130.

3.1.8 Identification and Traceability. - Identification and traceability shall be in accordance with the requirements of Specification MA 0201-0208.

3.1.9 Lubrication. - Lubrication of components, where required, shall be in accordance with the requirements of Specification MIL-L-6880. No petroleum-base lubricants shall be used. Lubricants shall be of the silicone base, fluorolube, oxylube 702, and dry film type. Lubrication shall not cause any toxic or flammable substances to occur in the CM or in the environmental control system.

3.1.10 Reliability. - An integrated reliability program, generally in accordance with Specification MIL-R-27542, shall be conducted throughout the design, development, fabrication, checkout and acceptance of Boilerplate Number 13.

3.2 Configuration. - The configuration of Boilerplate Number 13 is shown in Figure I. For detailed configuration information, refer to SID Drawing B14-000002-171. The Saturn I Launch Vehicle is shown for information purposes only.

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3.2.1 Launch Escape System. - The LES shall consist of the following major components:

(a) Q-ball assembly

(b) Ballast enclosure

(c) Pitch control motor (inert)

(d) Pitch control motor support assembly

(e) Tower jettison motor

(f) Launch escape motor (inert)

(g) Structural skirt

(h) LES tower sequencers

(j) Launch escape tower.

3.2.1.1 Q-Ball Assembly. - The NASA furnished Q-ball assembly, to be installed at AMR, shall consist of three differential pressure transducers with associated attachment fittings and electrical wiring. The Q-ball shall be located in the apex of the LES and shall sense airflow direction through ports in the surface of the enclosure. Data acquired from the Q-ball shall include angel of attack. angle of slideslip, and dynamic ram pressures. The input voltage shall be 28 volts dc. The transducers shall be capacitive-balanced with conversion of input power to 8 kilocycles. The output of the transducers will be proportional to the three differential pressures measured. The outputs shall be applied to the S-IV booster instrument unit where they shall be summed and amplified in an analog

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control computer. The amplified dc signals shall be transmitted to the guidance and control actuators of the active stage of the Saturn I booster to control the flight path of the boilerplate up to booster stage cut-off.

3.2.1.2 Ballast Enclosure. - The ballast enclosure shall provide structure, for mounting the Q-ball assembly, and capability for accommodating 1500 pounds of lead ballast.

3.2.1.3 Pitch Control Motor. - The pitch control motor for Boilerplate Number 13 shall be an inert rocket motor and shall simulate structure and mass distribution, by use of inert propellant, of an active pitch control motor.

3.2.1.3.1 Pitch Control Motor Support Assembly. - The pitch control motor support assembly shall provide the means for housing and mounting the pitch control motor and associated hardware.

3.2.1.4 Tower Jettison Motor. - The tower jettison motor shall be employed for the removal of the LES tower from the CM. The motor shall be designed to operate over an altitude range from sea-level to vacuum. The motor shall be a solid propellant motor 55.6 inches in length and 26 inches in diameter. The motor shall have two fixed nozzles canted 30 degrees from the mean motor centerline. The resultant thrust axis shall be located 2.5 degrees plus or minus 30 minutes from the mean motor

centerline of the pitch plane. The tower jettison motor shall weigh 534 pounds, which includes the inner stage structure, shall develop 33,000 pounds thrust and shall fire for 1.2 seconds. The rocket motor shall be ignited by a pyrogen type igniter which shall utilize two hotwire initiators for redundancy.

3.2.1.5 Launch Escape Motor. - The launch escape motor for Boilerplate Number 13 shall be inert. It shall simulate structure and mass distribution of an active launch escape motor.

3.2.1.6 Structural Skirt. - The structural skirt shall be the intermediate structure between the base of the launch escape motor and the top of the LES tower. The structural skirt shall be constructed of a forged ring with longerons, welded on a shear skin, that shall transfer uniform load from the LES to four points at the launch escape tower legs.

3.2.1.7 LES Tower Sequencers. - Two LES tower sequencers shall be installed on the underside of the structural skirt. Each tower sequencer shall be 2.5 inches in width, 10.0 inches deep, and 4.0 inches high. The two sequencers shall be totally redundant for increased reliability. For a functional description of the sequencers, see Paragraph 3.2.1.9.3.

3.2.1.8 Launch Escape Tower. - The launch escape tower shall be a

4-legged, truncated, rectangular cross-sectioned, pyramid structure of welded, tubular, titanium alloy. The tower shall be 120 inches in length with a base 46 inches by 50 inches. The tower shall form the intermediate structure between the CM and the escape, jettison, and pitch control motors. At the bottom, quick-release mechanisms shall be incorporated to attach the tower legs to the CM. The tower structure shall be covered with ablative material, Buna - N rubber sixty per cent silica filled.

3.2.1.9 LES Electrical System. - The LES electrical system shall consist of:

(a) Wiring harnesses and associated attachments

(b) Hotwire initiators

(c) Launch escape tower sequencers.

3.2.1.9.1 LES Electrical Wiring Harness. - Redundant wiring harnesses shall be bonded to the exterior of the launch escape motor and associated redundant harnesses shall be integral to the tower structure. The wiring harnesses shall provide the means of connecting the rocket motor and separation circuits with the sequence controllers and the instrumentation components with the communications equipment. Each tower structure harness shall have a breakaway type plug that shall permit the harness to be detached, at the separation plane, when the launch escape tower is jettisoned.

3.2.1.9.2 LES Hotwire Initiators.- The LES hotwire initiators shall contain two dual wired, single mode circuits. One circuit shall contain the electrical wiring, initiators, and explosive charges to detonate the tower jettison motor igniters. The other circuit shall contain the electrical wiring and hotwire initiators to detonate the explosive bolts required in the LES-CM separation system.

3.2.1.9.3 Launch Escape Tower Sequencers.- The launch escape tower sequencers shall receive input signals from the mission sequencer. The launch escape tower sequencers shall provide electrical signals in proper sequence to: (1) detonate the launch escape tower - CM attachment explosive bolts, and (2) energize the tower jettison motor by detonating the motor igniter. The sequencers shall provide circuits for monitoring the functional status of critical control circuits by GSE during checkout operations. The use of two launch escape tower sequencers will provide total redundancy for reliability.

3.2.1.10 LES Pyrotechnic System.- The LES pyrotechnic system shall consist of:

(a) Pyrotechnic batteries

(b) Electrical wire busses.

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(c) Hotwire initiators.

(d) Pyrotechnic cartridges.

The two pyrotechnic batteries shall be the power source for supplying dc current to the pyrotechnic devices. The electrical wire busses, incorporated in the wiring harnesses, shall carry current from the pyrotechnic batteries to the high resistence hotwire initiators which shall supply current to detonate explosives charges for jettison motor ignition and tower separation. The pyrotechnic system shall be redundant for reliability.

3.2.1.11 LES Umbilical System. - The LES umbilical system shall provide means by which the LES and CM are linked electrically. Two electrical connectors shall join the electrical systems. The connectors shall be located in the separation plane adjacent to an escape tower leg well in the CM forward heat shield. The receptacle portions of the connectors shall be located on the CM. The plug portion of the connectors shall be attached to the nearest tower leg by a lanyard. When the escape tower separates from the CM, the lanyard shall pull the plugs from the receptacles.

3.2.1.12 LES R and D Instrumentation. - The LES R and D instrumentation shall consist of temperature measuring devices. Data acquired by these data devices shall be transmitted to the R and D telemetry equipment by means of the electrical wiring harness for transmission

to the ground station. Refer to Figure 6 for LES tower sensor locations.

3.2.1.13 LES Tower - CM Separation System. - The LES tower separation system contains four explosive bolts that secure the tower to the CM. Each bolt shall contain an explosive charge in the center which shall be detonated by the hot wire initiators. Release of the tower shall be accomplished by simultaneous detonation of the four explosive attachment bolts. The hotwire initiators shall be energized by positive 28-volt dc signals received from the tower sequencers. The mission sequencer shall transmit electrical signals to the tower sequencers through the LES-CM umbilical. To accomplish LES-CM separation and launch escape tower jettison, the tower sequencers shall simultaneously apply detonation signals to the explosive bolt hotwire initiators and to the tower jettison firing units which shall cause motor ignition. The LES tower assembly shall then be released and propelled clear of the boilerplate trajectory. Umbilical cables shall be parted by force on the lanyard-type disconnects when the LES jettison motor accomplishes LES-CM separation.

3.2.2 Command Module. - The CM shall consist of the following:

(a) CM structure

(b) Electrical power system (EPS)

(c) Mission sequencer

(d) The R and D communications equipment

(e) R and D instrumentation equipment

(f) Environmental control system (ECS).

3.2.2.1 Command Module Structure. - The CM shall be of conical design, 141 inches high and 154 inches in diameter at the base with a net weight of 9000 pounds. The structure shall be fabricated from aluminum with a skin thickness of 0.190 inch. Attach fittings shall be provided at the forward bulkhead to engage the launch escape tower. The configuration of the CM shall be in accordance with SID Drawing B16-000002-211 and shall be similar to the ultimate spacecraft CM. All equipment in the CM shall be placed as near as possible to the position to be occupied in the ultimate spacecraft CM. The interior of the CM shall be insulated to protect the equipment from exterior thermal loads. The CM structure shall include the following:

(a) Cabin housing

(b) Heat shield structure

(c) Separation system.

3.2.2.1.1 Cabin Housing. - The CM shell shall be constructed of aluminum alloy welded into two subassemblies, (1) the forward crew

compartment and (2) the aft crew compartment. The subassemblies shall be bolted together and the aft skirt frames and skin shall be attached by mechanical fasteners. The CM shall be covered with cork insulation material to protect the aluminum structure against overheating.

3.2.2.1.2 Forward Bulkhead and Egress Tube. - The forward bulkhead structure shall consist of a double skin with riveted stiffeners. The closeout skin shall be attached to the stiffeners by blind fasteners. The egress tube shall consist of a welded sheet tube of aluminum welded to the forward bulkhead. A cover plate shall be bolted to the top of the egress tube.

3.2.2.1.3 Forward Crew Compartment. - The forward crew compartment shall consist of multi-stiffeners welded to the outer skin. The stiffeners shall consist of four main longerons attached to the launch escape tower attach fittings in the forward bulkhead and terminate in the mid-ring splice joint at the aft end of the forward section of the crew compartment. Several secondary longerons shall be utilized for load transfer from the forward bulkhead to the mid-ring. The remaining stiffeners shall assist the skin in resisting airloads.

3.2.2.1.4 Aft Crew Compartment. - The aft section of the crew compartment shall consist of a sidewall with stiffeners, corresponding to those of the forward section of the crew compartment, and form the mating aft

section of the crew compartment mid-ring to the machined ring forging at the junction of the sidewall and the floor.

3.2.2.1.5 Apex Forward Heat Shield Compartment Cover. - The apex forward heat shield compartment cover structure shall form the forward section of the CM structure and shall consist of an aluminum alloy skin and stiffeners utilizing riveted and bolted construction.

3.2.2.1.6 Aft Heat Shield. - The aft heat shield inner and outer skin shall be resin-impregnated, glass laminations. The core shall be constructed of aluminum honeycomb and shall have aluminum inserts. Attach fittings for the heat shield support shall be mounted to three of the aluminum inserts. The remaining inserts shall be used as compression pads for the mating of the CM and the SM.

3.2.2.1.7 Access Hatch. - The main hatch shall provide access to the CM interior. The hatch shall be constructed of reinforced aluminum plate and shall be bolted into place. It shall be located in the CM sidewall over the head of the center couch position.

3.2.2.1.8 Access Doors. - Access doors shall be provided in the skirt structure for servicing the heat shield attach struts. Four openings shall be provided in the forward crew compartment structure, 90 degrees apart, for telemetry antennas.

3.2.2.3 Electrical Power System. - The EPS shall supply power to all operational units of the communications and instrumentation system for switching and distribution of events that occur during a mission. The EPS shall consist of the following components:

(a) Two 120-Ampere hour main batteries

(b) Four 5-Ampere hour batteries

(c) Power control box

(d) Junction box.

The two 120-Ampere hour main batteries shall provide the electrical power required to energize the instrumentation devices such as sensors, amplifiers, and telemetry equipment. The main batteries shall supply power to busses A and B of the power control box through closed contacts of the internal A and B power control relays. These relays can only be energized by GSE action. The power control relays shall remain open when power is being supplied by GSE to preserve battery power. When GSE umbilicals are disconnected, the relays shall close and the system shall be supplied by the batteries. Two 5-Ampere hour batteries shall provide the electrical power to energize the redundant tower separation system components. Two 5-Ampere hour batteries shall provide the electrical power to operate the redundant sequencer logic circuits. Redundant batteries and circuits, operated in parallel, will provide high reliability required to assure a successful mission.

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3.2.2.4 Mission Sequencer. - The mission sequencer shall be a solid state switching device located in the CM. The unit shall contain redundant transistor switches (Channels A and B) which shall provide control of the two tower motor switches located in the tower sequencer. Twelve seconds after S-IV ignition a signal from the launch vehicle instrument unit will be received by the mission sequencer. Transistor switches will then be energized by the logic battery voltage and an electrical signal will be provided to the tower sequencer. In addition to the energizing circuitry, the mission sequencer shall contain provisions for safe/arm control from the GSE hard-line monitoring and telemetry monitoring.

3.2.2.5 Environmental Control System. - The ECS shall provide coolant, by use of a closed circuit cooling system, to five coldplates, three for telemeter modulation packages and two for C-band transponders. The ECS shall also provide a continuous flow of air for crew compartment cooling. The ECS shall contain the following major components:

(a) Supply tank

(b) Coolant pump

(c) Coldplates

(d) Heat exchanger and fan

(e) Thermal control valve

(f) Temperature and pressure transducers

(g) Accumulator tank for water/glycol coolant.

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The ECS water/glycol coolant shall be contained in a 250-pound capacity tank. A coolant pump shall circulate the water/glycol coolant throughout the ECS. The pump shall be operated on 400 cycle, 115 volts current which shall be obtained through a 28-volt dc inverter supplied by the B bus of the power control box. A continuous flow of coolant to the five coldplates, which shall be connected in series, shall be maintained by the pump. The coolant shall then be circulated to the heat exchanger where ambient air shall be directed around the coils of the heat exchanger by the heat exchanger fan. The thermal control valve, an automatic by-pass valve, shall regulate the flow of coolant out of the tank. The thermal control valve shall be set to maintain a system temperature of 38 degrees plus 4, minus 3 degrees Fahrenheit. GSE shall furnish cooling up to T-150 seconds before lift-off. An umbilical disconnect shall be removed at that time and the boilerplate closed circuit ECS shall maintain the required temperature level. Temperature and pressure transducers shall be provided for ground operations use only.

3.2.2.6 Research and Development (R and D) Equipment. - The R and D equipment will provide a means of acquiring data pertinent to the mission of Boilerplate Number 13. Acquisition of data during flight will be by means of end instruments such as pressure transducers, and vibration and temperature sensors. RF telemetry will transmit data acquired to ground receiving stations.

3.2.2.6.1 RF Electronics Equipment. - The RF telemetry equipment for Boilerplate Number 13 will consist of an FM/FM system containing the following major components:

(a) Signal conditioning box

(b) Three telemetry subcarrier assemblies

(c) Three telemetry RF assemblies

(d) 90 x 10 commutator

(e) 90 x 1.25 commutator.

Figure 7 is a block diagram of the RF electronics system.

3.2.2.6.1.1 Telemetry Subcarrier Assemblies. - The three telemetry subcarrier assemblies will consist of the following components:

(a) Subcarrier oscillators

(b) Matching amplifier

(c) Voltage regulator

(d) Five-point voltage calibrator.

3.2.2.6.1.2 Telemetry RF Assemblies. - The three RF telemetry assemblies will consist of the following components:

(a) Band pass filter

(b) RF amplifier

(c) Power supply

(d) RF transmitter

3.2.2.6.2 Data Equipment. - The primary data gathering equipment will be ground station tape recorders. In addition to recording 90 x 10 commutator and 90 x 1.25 commutator information and all T/M continuous channels, those measurements requiring high-frequency response will be tape recorded. Each tape recorder unit will consist of a tape recorder, tape recorder electronics, and a remote control box. Capacity will be 750 feet of 1-inch tape operated at 15 IPS with approximately 10 minutes recording time.

3.2.2.6.3 Antenna Equipment. - The R and D antenna system shall consist of, (1) the VHF omni antenna system and (2) the beacon antenna system. For detailed listing of antenna components refer to Appendix B.

3.2.2.6.3.1 R and D VHF Omni Antenna System. - The R and D VHF omni antenna system shall consist of a modified discone antenna with fiberglass honeycomb radome, mounted at the apex of the CM; and an R.F. low pass filter and R and D multiplexer, with associated coaxial cable, mounted in the CM crew compartment.

3.2.2.6.3.2 Beacon Antenna System. - The R and D beacon antenna system shall include four cavity-backed helix antennas, two power dividers, and associated cables. The four beacon antennas shall be flush-mounted about the periphery of the SM at 90 degree intervals and shall be located at station X_s 316.8.

3.2.2.6.4 C-Band Transponder. - Two C-Band transponders will be installed in Boilerplate Number 13 to provide accurate tracking capabilities. Each beacon transponder will operate independently and will be power-divided into two of the four beacon antennas.

3.2.2.6.5 R and D Instrumentation. - A telemetry system will provide means of data acquisition from the boilerplate during flight. A telemetry station will be positioned on the ground for the flight. The FM/FM system will be used for telemetry communications.

3.2.2.6.5.1 R and D Instrumentation Equipment. - The R and D instruments will consist of, but not be limited to, thermistors, crystal accelerometers, strain gauges, and pressure transducers. Signal conditioning equipment will consist of bridge adjust units and thermocouple compensators. These signal conditioning devices will shape information received from the sensors into a modulation voltage for the subcarrier oscillators. The amplifiers will have the capability of being remotely calibrated for both R (range -85 percent full scale) and Z (zero -15 percent full scale). The instrument sensor locations are shown in Figures 2 through 6. For station locations refer to SID 63-563.

3.2.3 Service Module. - The SM for Boilerplate Number 13 shall be of boilerplate configuration. Provisions for ballasting the SM, as required, shall be incorporated in the SM structure.

3.2.3.1 Service Module Structure.- The SM shall be of semi-monocoque type aluminum structure, 124 inches in length and 154 inches in diameter, and shall be attached to the SM insert with bolts. It shall be attached to the CM by a non-functional separation mechanism.

3.2.3.2 CM-SM Fairing.- The boilerplate shall include a fairing between the CM and SM. This fairing shall provide closure of the gap which will be left, by the curvature of the CM aft heat shield, when the CM is mated to the SM and is resting on the compression pads. An inert separation mechanism and a fixed CM-SM umbilical shall be housed within the fairing.

3.2.3.3 SM Insert.- The SM insert shall be located between the SM and the boilerplate launch vehicle adapter. It shall be of semi-monocoque aluminum structure, 52 inches in length and 154 inches in diameter, and shall be bolted to the SM and adapter.

3.2.3.4 SM-Launch Vehicle Adapter.- The SM-launch vehicle adapter shall be of semi-monocoque aluminum structure, 92 inches in length and 154 inches in diameter, and shall be bolted to the SM extension and the S-IV stage. It shall contain an airconditioning barrier as well as instrumentation sensors and associated cabling.

3.2.3.5 R and D Instrumentation.- The R and D instrumentation for Boilerplate Number 13 SM will be installed at critical locations within the SM, SM fairing, SM insert, and SM adapter. The R and D instrumentation

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will consist of the following sensors:

(a) Accelerometers

(b) Calorimeters

(c) Fluctuating pressure transducers

(d) Vibration transducers

(e) Strain gages.

The sensors will receive dynamic stimuli and relay electrical impulses to the telemetry equipment through the umbilical. The flight telemetry equipment will transmit this data to the ground telemetry station. For location of the various SM sensors refer to Figures 2, 3, and 4.

3.2.4 Separation System CM - SM. - The CM shall be mated to the SM on six hard compression pads which shall be capable of withstanding shear and compression loads. Positive attachment shall be obtained by utilizing three preloaded tension tie devices which shall be secured to the aft portion of the CM and to the upper beam of the SM. CM-SM separation shall not be a requirement for the mission of Boilerplate Number 13; therefore, the separation system shall be inert.

3.2.5 Reaction Control System (RCS). - The reaction control system shall consist of simulated RCS quadrant packages having the same size, weight, shape, location, and aerodynamic characteristics as active SM RCS packages.

3.2.6 Launch Vehicle. - The launch vehicle data are not a requirement of this End Item Specification. Data supplied herein are for informational purposes only to establish continuity of events pertinent to the mission of the boilerplate.

3.2.6.1 Saturn I Launch Vehicle. - The Saturn I Launch Vehicle will consist of the S-I stage and the S-IV stage. The launch vehicle will provide booster capability for the launch of Boilerplate Number 13. Refer to Specification SID 63-941 for launch vehicle - boilerplate interface requirements.

3.3 Performance. - NASA programming provides for the launch of Boilerplate 13 into a nominal 100 nautical mile earth orbit by the Saturn I launch configuration. Data acquired during the first revolution of the 90-minute orbit will be transmitted to ground stations by means of telemetry.

3.3.1 General Flight Plan. - The boilerplate will be launched by the Saturn I from Complex 37B at an azimuth of 90 degress and rolled to an azimuth of 105 degrees prior to the start of the pitch maneuver. Figure 8 shows a flight profile from launch to orbit insertion indicating major events during the flight. No separation of the boilerplate from the S-IV stage is planned. No recovery is planned.

4. QUALITY ASSURANCE

4.1 General Quality Assurance Provisions. - The principal contractor (S&ID) shall be responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the principal contractor may utilize his own or any other inspection facilities and services acceptable to the NASA. Inspection records of the examinations and tests shall be kept complete and available to the NASA as specified in the contract.

4.2 Principal Contractor's Quality Assurance Program. - The principal contractor shall establish a quality assurance program in accordance with the requirements of Paragraph 6 of Exhibit I of the Contract. Inspections and tests to determine conformance of Boilerplate Number 13 to contract and specification requirements shall be conducted prior to submission of the article to the NASA for acceptance.

4.2.1 Reliability Data. - The principal contractor shall act as a test historian and accumulate applicable data on spacecraft tests, plans, and performance from preparation to delivery. The data shall be used in

qualitative and quantitative assessments of reliability and performance of each system, and of the ultimate spacecraft. This data, together with other appropriate data, such as acceptance data, shall be integrated with that accumulated from prior tests to form assessments. Thus, a probability of success may be developed for any given phase of the mission.

4.3 Examination. - Each assembly and all major components submitted for acceptance shall be subjected to a visual examination to determine conformance to materials, design, construction, dimensions, color and finish, product marking, and workmanship.

4.3.1 Components. - The principal contractor shall ascertain that, prior to assembly, all parts, components, assemblies, and systems procured under separate specifications or drawings have been inspected, tested, and accepted in accordance with their respective specifications or drawings.

4.4 Tests. - Each assembly, major component, and system submitted for acceptance shall be subject to performance tests as specified in applicable documents including SID 62-109.

5. PREPARATION FOR DELIVERY

5.1 Preservation, Packaging and Packing. - Preservation, packaging and packing shall be in accordance with the principal contractor's procedures specified in SID Process Specification MA 0116-012.

6. NOTES

None

CON[redacted]

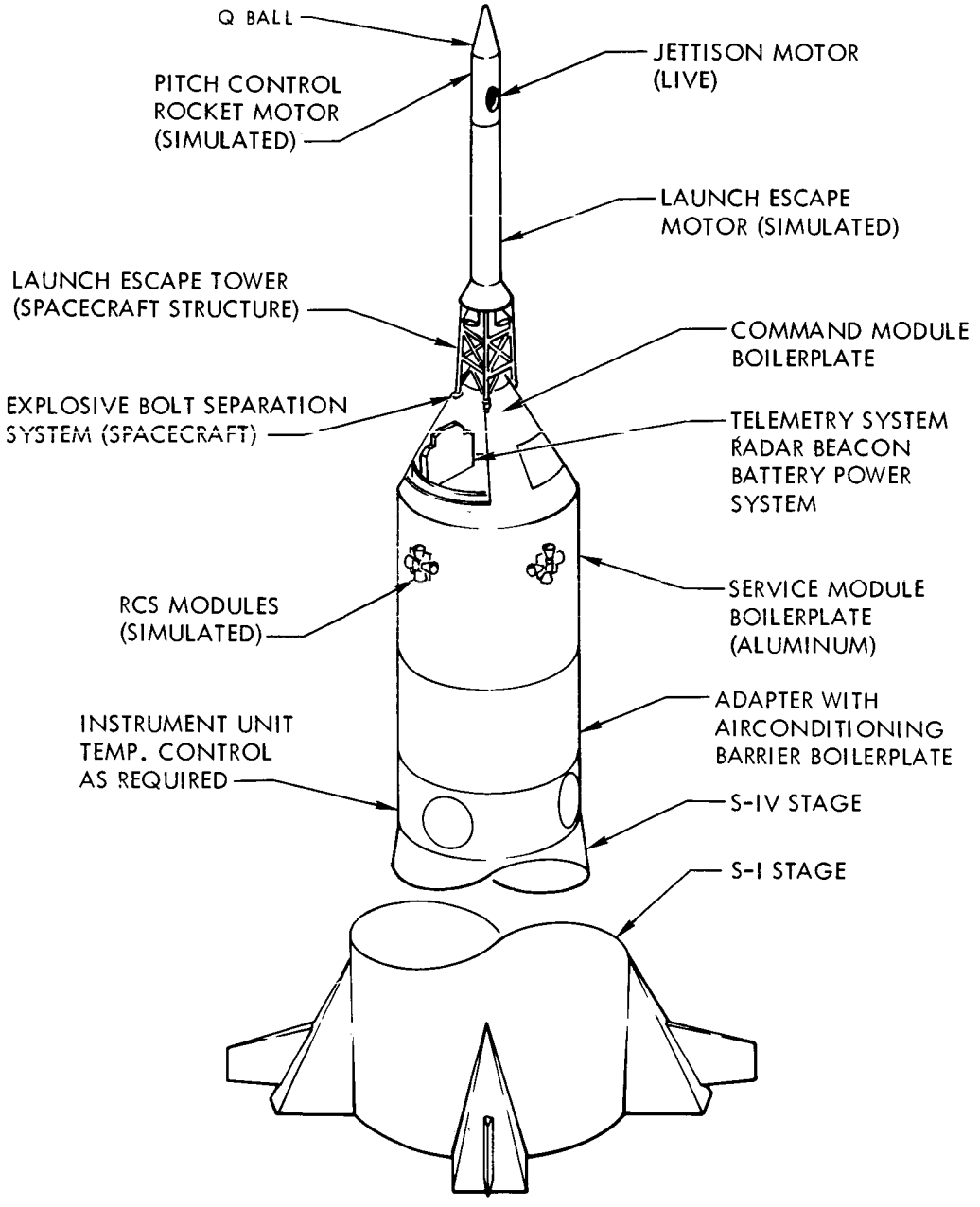
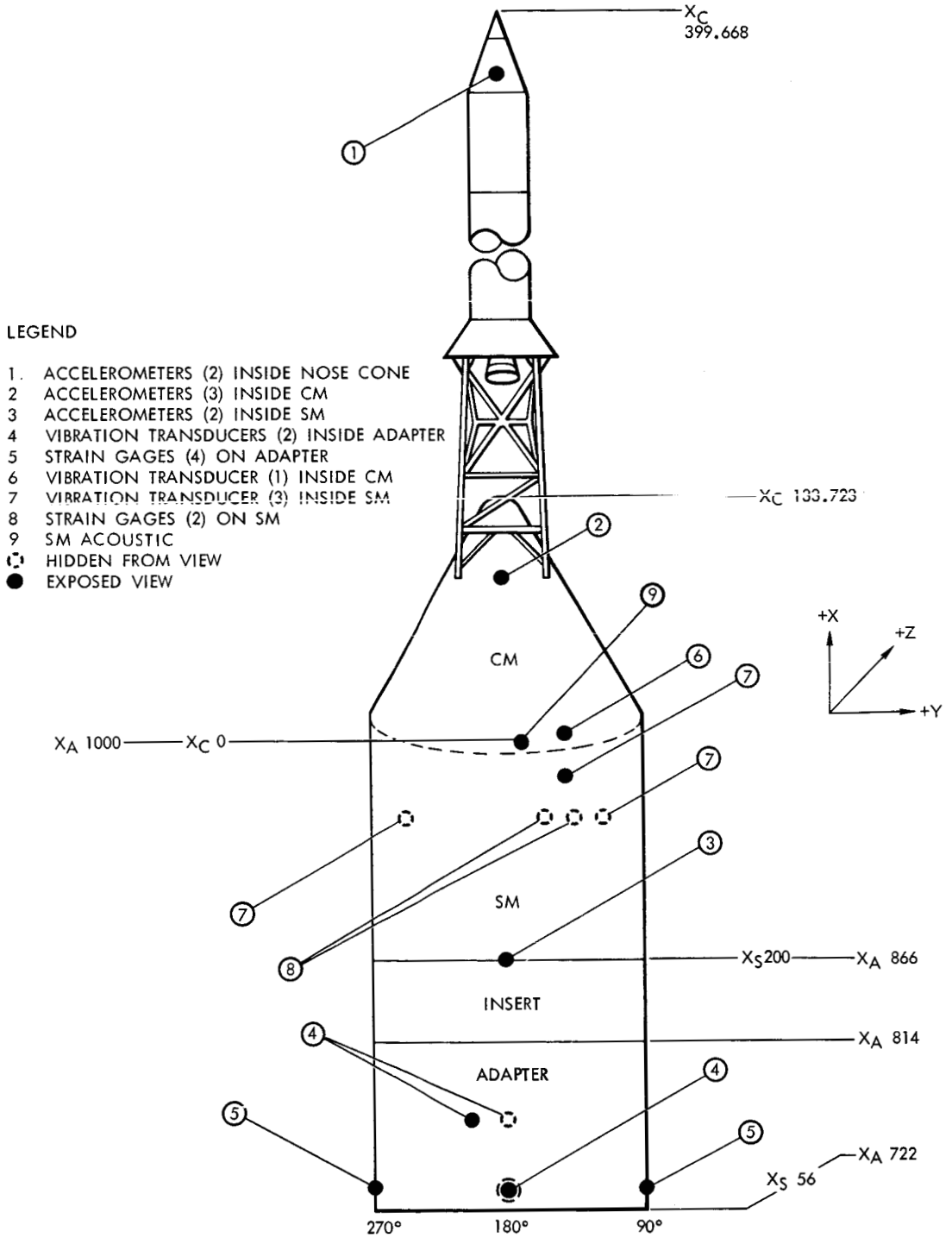


Figure 1. Configuration Boilerplate Number 13

[redacted]

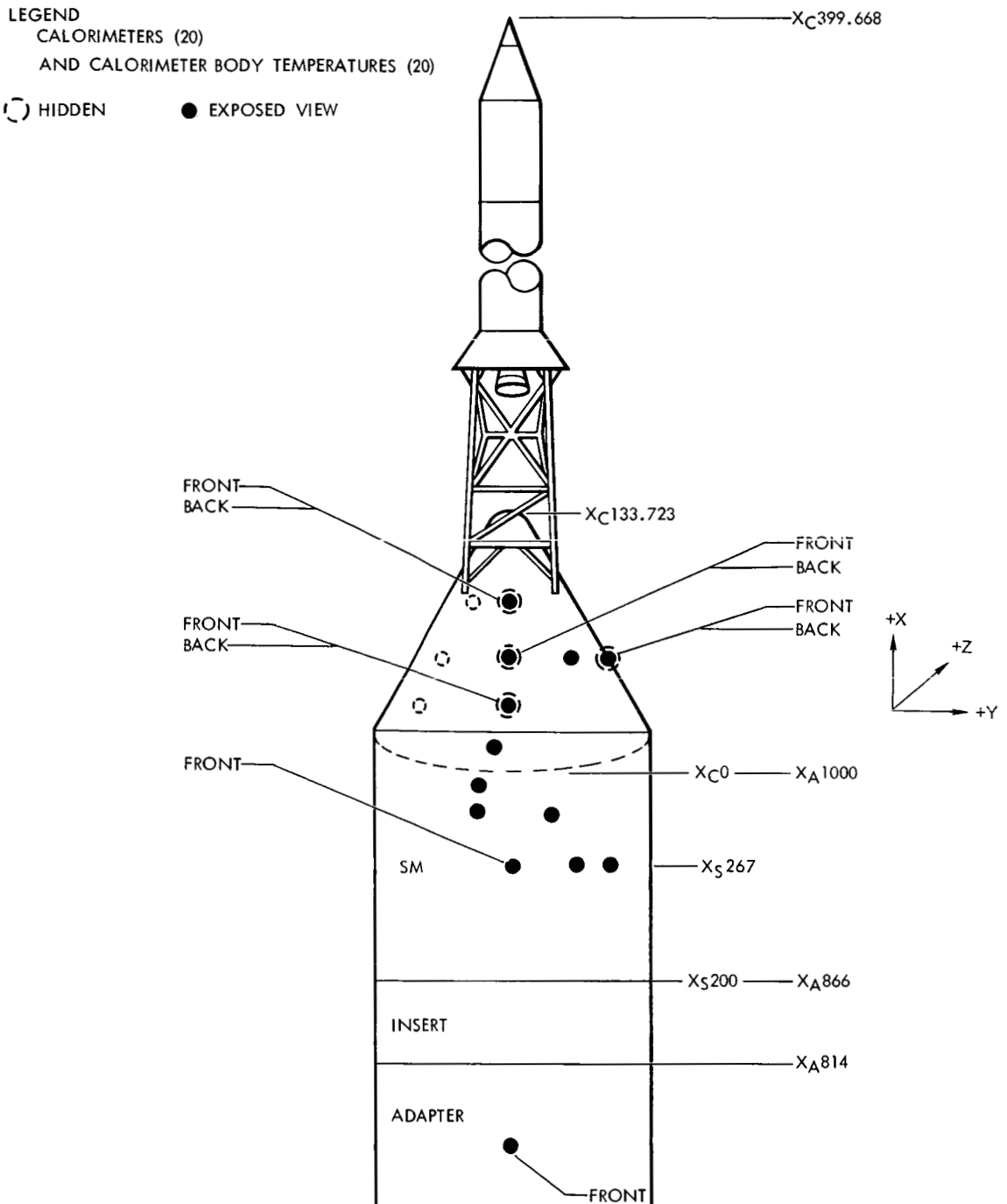


NOTES

1. THE MEASUREMENT LOCATIONS ARE REFERENCED FROM THE +Z AXIS (+Z = 0°), AND THE MEASUREMENT ANGLE INCREASES AS THE MEASUREMENT LOCATION CHANGES PROGRESSIVELY FROM THE +Z AXIS TO THE +Y AXIS.
2. SEE THE MEASUREMENT LIST FOR SPECIFIC MEASUREMENT LOCATIONS. (SID 63-563)
3. THE DIAGRAM IS NOT DRAWN TO SCALE.

Figure 2. Sensor Locations - Boilerplate

CONFID[redacted]



NOTES

1. THE MEASUREMENT LOCATIONS ARE REFERENCED FROM THE +Z AXIS (+Z = 0), AND THE MEASUREMENT ANGLE INCREASES AS THE MEASUREMENT LOCATION CHANGES PROGRESSIVELY FROM THE +Z AXIS TO THE +Y AXIS.
2. SEE THE MEASUREMENT LISTS FOR SPECIFIC MEASUREMENT LOCATIONS. (SID 63-563)
3. THE DIAGRAM IS NOT DRAWN TO SCALE.

Figure 3. Sensor Locations - Boilerplate

[redacted]

[redacted]

LEGEND:
15 FLUCTUATING PRESSURES

○ HIDDEN FROM VIEW

● EXPOSED VIEW

NOTES:

1. THE MEASUREMENT LOCATIONS ARE REFERENCED FROM THE +Z AXIS (+Z = 0°) AND THE MEASUREMENT ANGLE INCREASES AS THE MEASUREMENT LOCATION CHANGES PROGRESSIVELY FROM THE +Z AXIS TO THE +Y AXIS.
2. SEE THE MEASUREMENT LISTS FOR SPECIFIC MEASUREMENT LOCATIONS. (SID 63-563)
3. THE DIAGRAM IS NOT DRAWN TO SCALE.

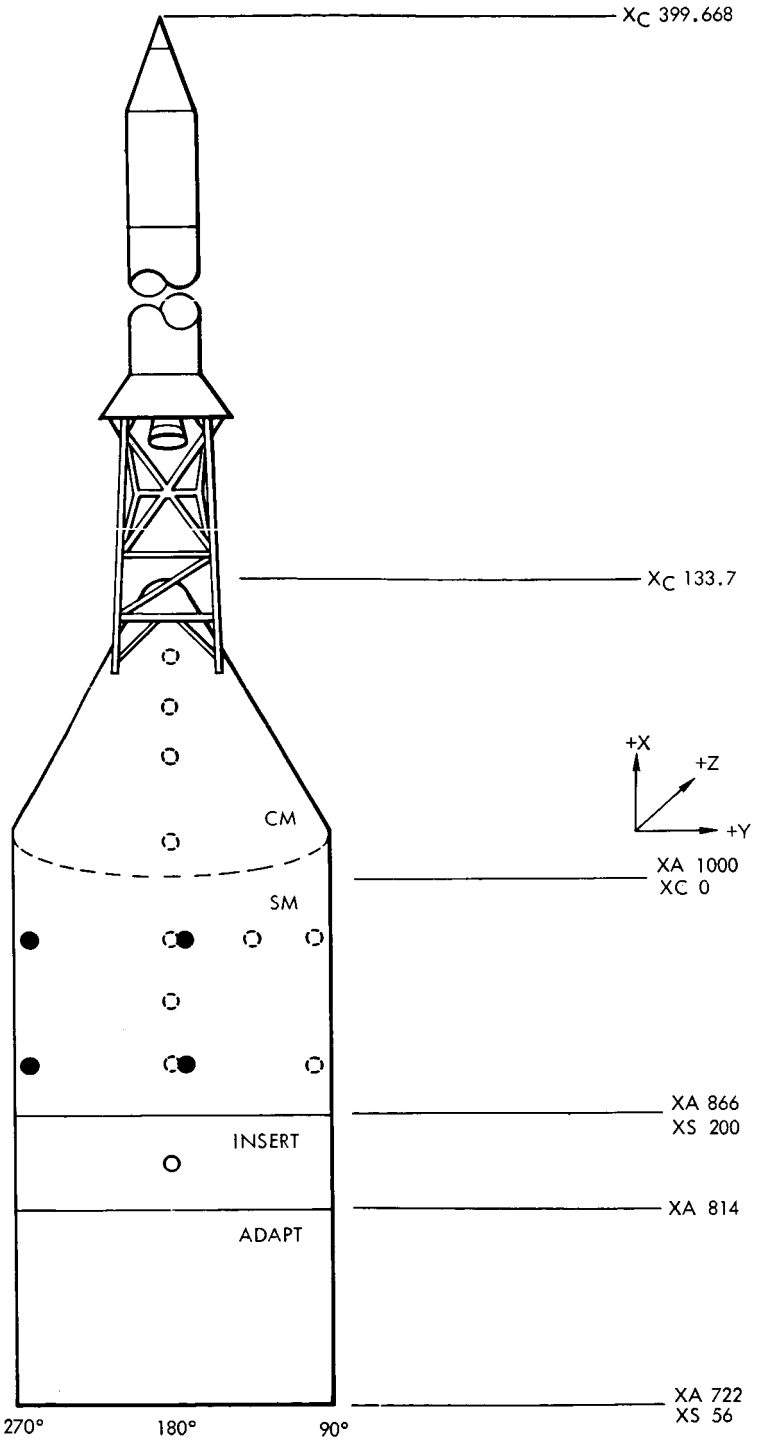


Figure 4. Sensor Locations - Boilerplate

[redacted]

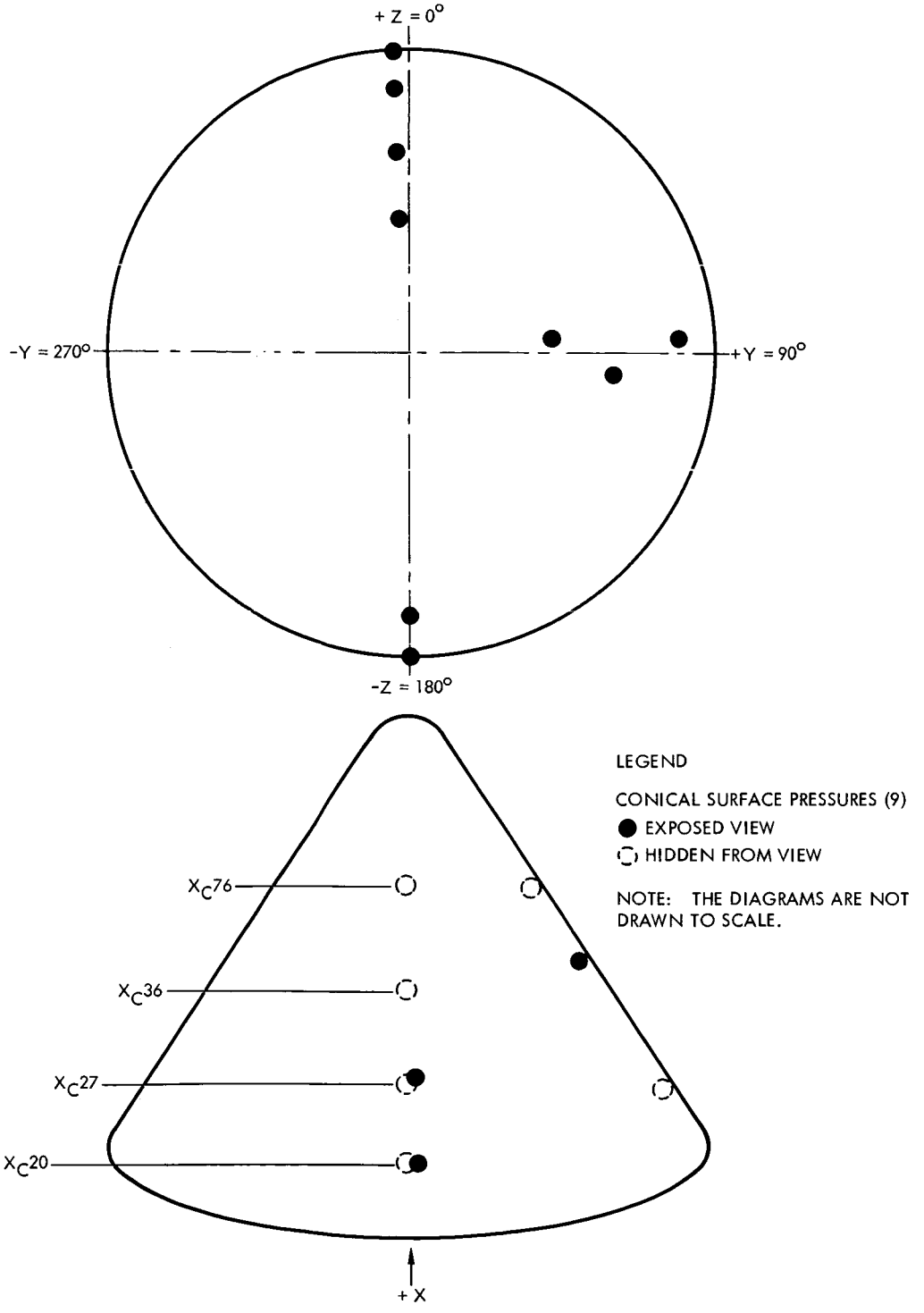


Figure 5. Sensor Locations - CM

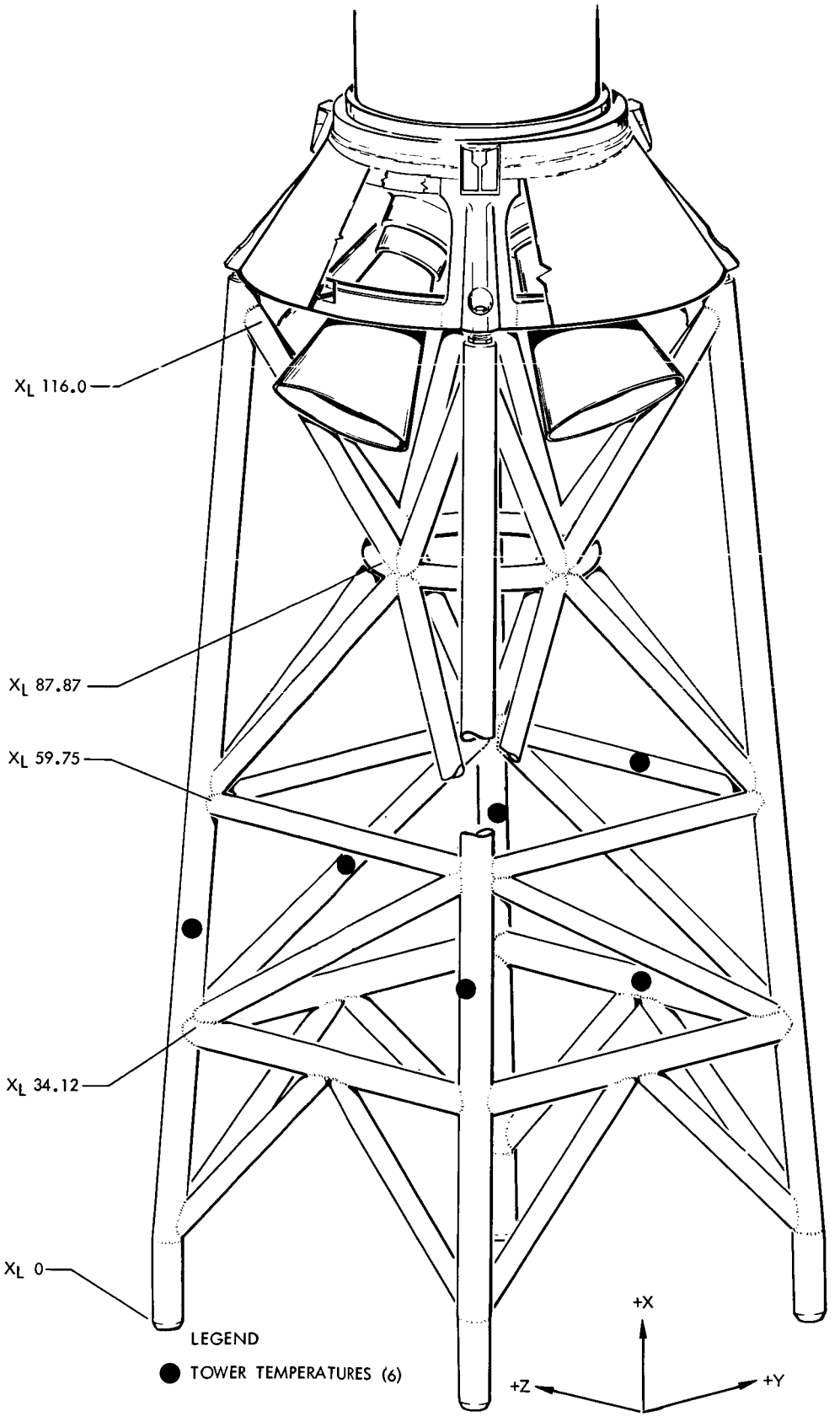


Figure 6. Sensor Locations - LES Tower

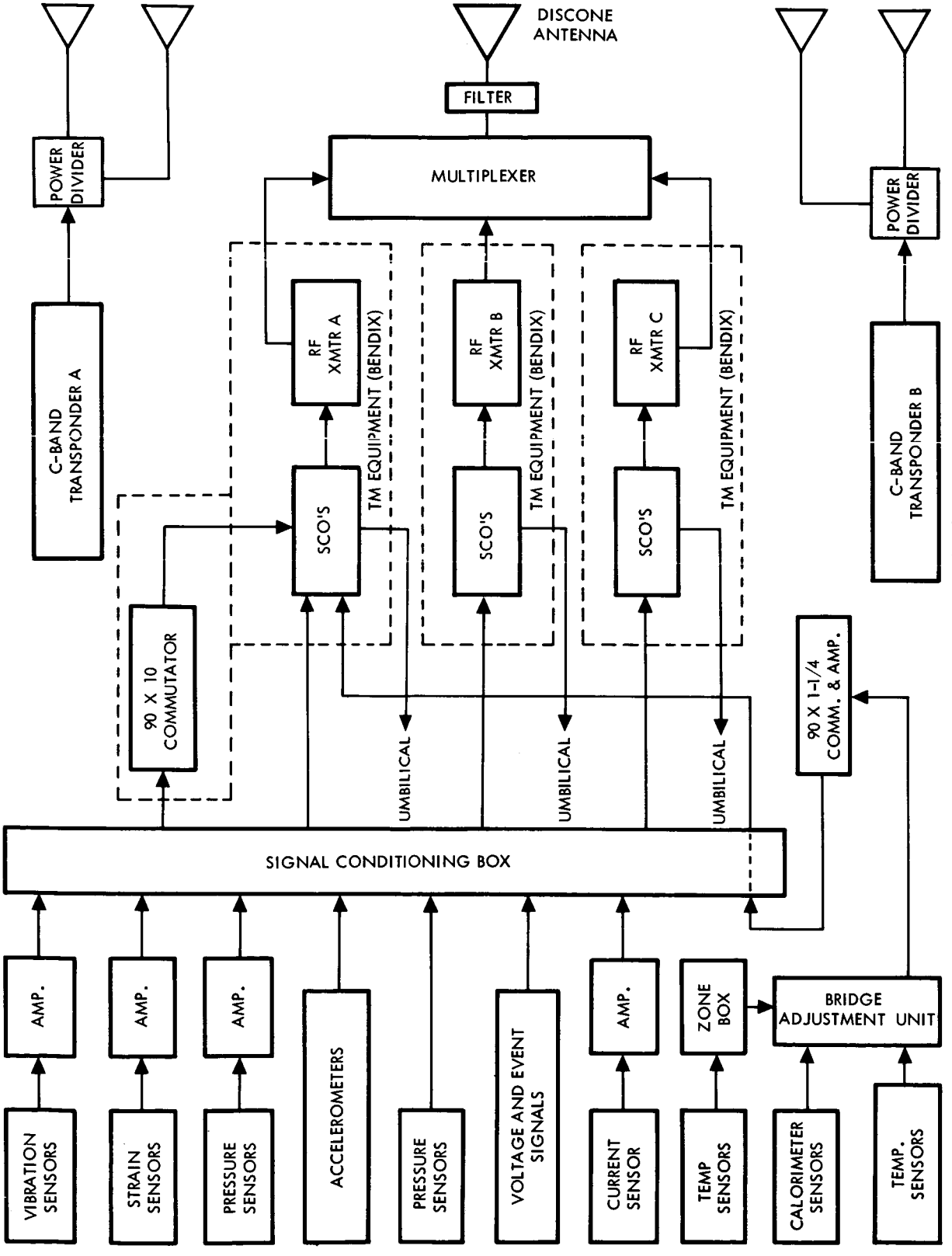
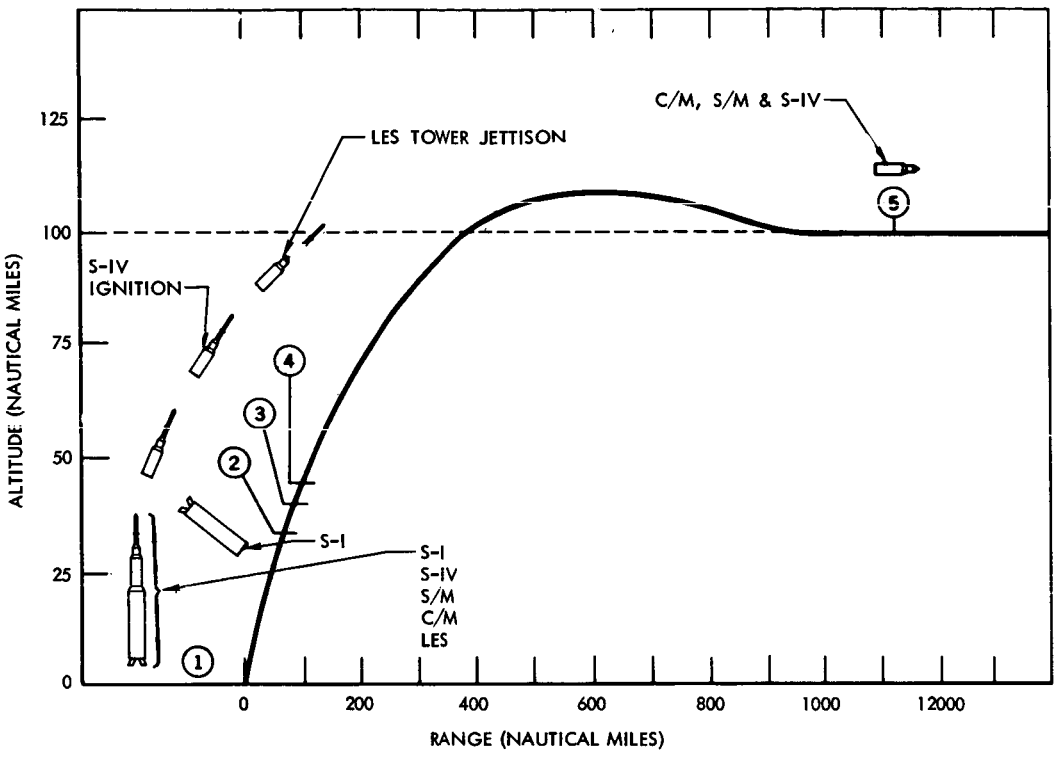


Figure 7. Instrumentation Block Diagram



CONDITIONS:

1. NO ATTITUDE CONTROL
2. NO PLANNED RECOVERY

FLIGHT SEQUENCE:

1. SATURN I LAUNCH
2. S-I BURNOUT AND SEPARATION
3. S-IV IGNITION
4. LES TOWER JETTISON
5. INJECTION INTO ORBIT AT S-IV BURNOUT

Figure 8. Boilerplate Number 13 Mission Profile

[redacted]

APPENDIX A

DRAWINGS

1. Scope.- The following list constitutes the drawings for Boilerplate Number 13. The top drawings for major items are reflected in this list.

Number	Title
B14-000002-171	General Assembly, Boilerplate 13
B15-000002-141	General Assembly, LES 7
V15-300001-111	Body Group Assembly
V15-300100-71	Tower Assembly
V15-300408-81	Structure Assembly
B15-400001-41	Power System Installation
B15-410001-41	Rocket Motor Set
B15-450013	Electrical System Installation
B15-451201	Electrical Installation - LET
B15-451210	Electrical Installation - Motor
B15-700013	System Installation - Electronic Control
V15-750013	Instrumentation Installation
B16-000002-211	General Assembly, C/M 13
B16-300013	Structure Complete
B16-301006-601	Structure Assembly
B16-301073-201	Forward Bulkhead Assembly
B16-311006	Structure Assembly Aft Crew
B16-320013	Ablative Cover

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DRAWINGS (Continued)

Number	Title
B16-326003-201	Forward Cover Assembly
B16-327006-81	Structure - Heat Shield
B16-331092	Ballast Installation
B16-577015-21	Structure Assembly
B16-450013	Electrical Installation
B16-451201	Electrical Installation, Crew Compartment
B16-456201	Electrical Installation, Forward Compartment
B16-457201	Electrical Installation - Aft Compartment
B16-456251	Electrical Installation - Forward Heat Shield
B16-610001	Equipment Installation Cooling System Complete
B16-700013	System Installation - Electronic Control
B16-750013	Communications & Instrumentation Installation
B16-750213	Instrumentation Installation
B17-000002-131	General Assembly, SM 8
B17-300013	Structure Complete
B17-320101-101	Structure Assembly
B18-320113	Structure - Insert
B17-320139	Ballast Installation
B17-450013	Electrical Installation
B17-700013	ECS Instrumentation
B17-750013	Instrumentation Installation

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DRAWINGS (Continued)

Number	Title
B18-000002-151	General Assembly, Adapter 14
B18-300013	Structure Complete
B18-320102-101	Structure Assembly
B18-450013	Electrical Installation
B18-700013	System Installation - Electronic Control

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APPENDIX B

PROCESS SPECIFICATIONS

1. Scope. - The following list constitutes the process specifications for Boilerplate Number 13. Section I lists General Process Specifications, Section II lists Specific Process Specifications.

SECTION I

Number	Title
AA 0109-012	General Procedure for Brush Type Electroplating
FA 3-8	Insulation of: Nuts, Bolts, Screws, Studs, and Hi-Shear Rivets
FA 507-3	Fabrication of Silicon Resin Impregnated Glass Fabric Laminates
FA 507-5	Sheet Metal, Extrusion and Laminated Plastic
FA 6-12	Rubber Stamp Markings, Application of
FA 6-78	Stenciling Miscel. Marking Procedure for Aircraft
FA 6-91	Seams & Stitching
FA 6-236	Attaching Sockets to Wire Ropes
FA 7-43	Laminating, Epoxide Resin. Cold Curing. Non-Structural
FP 1-1	Sheet, Standard Detail
FP 5-10	Application of Moisture and Fungus Resistance Coating
HA 0109-006	Anodizing of Magnesium Alloys (Dow No. 17)
LA 0101-006	Installation of Bearings
LA 0102-011	Cable Terminal Assy. Fabrication, Pre-Stretching and Proof Loading

[redacted]

PROCESS SPECIFICATIONS (Continued)

Number	Title
LA 0103-006	Thermal Cutting
LA 0104-003	Marking of Parts & Assemblies
LA 0104-005	Use & Application of Fluid Line System Ident. Markings
LA 0104-006	Rubber Stamp Marking; Application of
LA 0104-012	Application of Decalcomanias
LA 0106-006	Adhesive Bonding of Aluminum Alloy Assy's for Usage at -67° to 180° F.
LA 0106-007	Adhesive Bonding of Thermo Setting Plastics and Miscellaneous Materials for Usage From -67° to 180° F.
LA 0106-009	Adhesive Bonding of Thermo Setting Plastics & Miscel. Materials for Usage from 67° to 260° F.
LA 0106-023	Liquid Tight Sealing for Areas With Normal Temperature from -65° to 225° F.
LA 0106-034	Use of Room Temperature Vulcanizing Silicone Rubber Adhesive
LA 0111-006	Heat Treatment of Coating & Alloy Steels
LB 0160-131	Steel Wire, 17-7PH Corrosion Resistant Precipitation Hardening Spring Temper
MA 0101-005	Inst'l of Threaded & Collared Fasteners
MA 0102-001	Fabrication & Inst'l of Rigid & Flexible Tube Extrusions
MA 0102-002	Standard Details for Metal Sheet & Extrusions

[redacted]

PROCESS SPECIFICATIONS (Continued)

Number	Title
MA 0103-005	Tolerances on Machined Parts
MA 0103-006	Chem-Mill Processing of Welded Stainless Steel Tubing
MA 0105-002	Elev'd Temp. Restnt., Glass Fabric, Phenolic Lamit's, for Strut. Purposes
MA 0105-013	Compression Molded Parts, Phenolic Glass Fiber Filled
MA 0106-001	Sealing of Pressurized or Fuel Compartments for Short Term Service at Temps. up to 400° F.
MA 0106-003	Bonding With Epoxy Polymide Adhesive
MA 0106-008	Application of Metal Foil Nameplates
MA 0106-017	Aerodynamic Smoothing With Flexible Joint Filler
MA 0106-023	Bond. With Low Temp. Curing Adhesive for Serv. at -67° to 300° F.
MA 0107-001	Fusion Welding
MA 0107-004	Fusion Welding
MA 0107-007	Brazing of Aluminum
MA 0107-010	Tinning & Soldering of Electrical & Electronic Components, for Aerospace Project
MA 0108-001	Polyurethane Coding
MA 0108-005	Application of Organic Finishes, General
MA 0108-006	Priming of Laminated & Molded Plastic Surfaces

CO[redacted]

PROCESS SPECIFICATIONS (Continued)

Number	Title
MA 0103-005	Tolerances on Machined Parts
MA 0103-006	Chem-Mill Processing of Welded Stainless Steel Tubing
MA 0105-002	Elev'd Temp. Restnt., Glass Fabric, Phenolic Lamit's, for Strut. Purposes
MA 0105-013	Compression Molded Parts, Phenolic Glass Fiber Filled
MA 0106-001	Sealing of Pressurized or Fuel Compartments for Short Term Service at Temps. up to 400° F.
MA 0106-003	Bonding With Epoxy Polymide Adhesive
MA 0106-008	Application of Metal Foil Nameplates
MA 0106-017	Aerodynamic Smoothing With Flexible Joint Filler
MA 0106-023	Bond. With Low Temp. Curing Adhesive for Serv. at -67° to 300° F.
MA 0107-001	Fusion Welding
MA 0107-004	Fusion Welding
MA 0107-007	Brazing of Aluminum
MA 0107-010	Tinning & Soldering of Electrical & Electronic Components, for Aerospace Project
MA 0108-001	Polyurethane Coding
MA 0108-005	Application of Organic Finishes, General
MA 0108-006	Priming of Laminated & Molded Plastic Surfaces

[redacted]

PROCESS SPECIFICATIONS (Continued)

Number	Title
MA 0108-009	Application of Epoxy-Polyamid Primer Coating
MA 0108-012	Application of High Emittance, High Reflectance White Temp Control Coating to Aluminum
MA 0108-013	Application of Air Drying & Breaking Eopxy-Amine Enamel
MA 0109-002	Phosphate Coatings for Ferrous Metal
MA 0109-003	Application of Chemical Films to Aluminum
MA 0109-004	Electrolysis Nickel Plating
MA 0109-005	Repair & Refinishing of Abraded, Scratched, Rework Corroded Metal Surfaces
MA 0109-006	Cadmium Plat. Cyanide Process
MA 0109-008	Cadmium Plat. Fluoborate Process
MA 0109-009	Chromic and Sulfuric Acid Antidizing
MA 0109-010	Hard Crominum Plating
MA 0110-001	Cleaning of Hose and Tube Assy's
MA 0110-010	General Cleaning Methods
MA 0110-011	Cleaning of Aluminum & Aluminum Alloys
MA 0110-012	Cleaning of Iron & Steel
MA 0110-013	Cleaning Corrosion & Heat Resistant Alloys
MA 0110-015	Cleaning Titanium & Titanium Alloys
MA 0110-018	Cleaning Components of Oxygen and Nitrogen Tetroxide Systems

[redacted]

PROCESS SPECIFICATIONS (Continued)

Number	Title
MA 0110-019	Cleaning of Copper & Copper Alloys
MA 0110-020	Abrasive Cleaning
MA 0110-022	Cleaning Components of Pressurizing Systems
MA 0110-024	Surface Preparation of Metals & Non-Metals for Adhesive Bonding
MA 0110-001	Heat Treatment of Ferrous & Non-Ferrous Alloys, General
MA 0112-003	Application of Solid Dry Film Lubricant
MA 0113-001	Electrical Bonding
MA 0113-002	Electronic Components & Hardware, Mounting of, Specification for
MA 0113-004	Wiring, GSE Ident. & Inst'l of
MA 0113-006	Bonding, Elect., Aerospace Ground Eq.
MA 0113-010	Elect. Bond, Flight Vehicles
MA 0116-001	Age Controls for Synthetic Rubber Parts, Hose & Hose Assemblies
MA 0116-002	Storage, Handling & Marking of Rubber Materials
MA 0116-012	Prep. for Delivery & Transp. of Apollo Boilerplates
MA 0201-0209	Identification and Traceability, Subcontractor and Supplier, Apollo Program, General Specifications for
MA 0303-0002	Cable, Apollo Boilerplate Launch Escape Motor, Looming of

CONFI[redacted]

PROCESS SPECIFICATIONS (Continued)

Number	Title
MA 0303-031	Electrical Wiring, Apollo Boilerplate Assy. & Installation of
MA 0303-032	Elect. Connector Assy's, Assy. of
MA 0303-033	Electrical Wires & Connectors, Stowage of
MA 0310-0001	Insulation of Burn-N Rubber, LET Application of
MA 0310-0002	Protective Coating, Ozone and Weather Resistant, LES 7 C/M - Application of
MA 0310-0003	Insulation of Thermo-Lagt AGT-500 LES System, Application of
MA 0311-0004	Insulation Procedure for Insulation Required On Boilerplates 13, 15, 18, & 22
MA 0606-002	Bonding of Wiring Harness Apollo LES
MA 0606-005	Potting of Umbilical Disconnects Apollo Boilerplate
MA 0610-007	Surface Preparation of Apollo Hardware for Adhesive Bonding
MB 0160-006	Maraging Steel, Bar, Extrusions, Forgings, & Forging Stock, Precipitation Harding (18Ni-9CO-5Mo-0.5Ti-0.-10Ai)
MP 050-0001	Weld Symbols
MP 121-0001	Code Rivet
NA 2-4502	Metal Nameplate
PR 10-8	NAA Foundry Control on Lead & Lead Alloy Castings

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PROCESS SPECIFICATIONS (Continued)

Number	Title
RA 0105-003	Plastic Tubing, Heat Reactive Inst'l
RA 0106-003	Use of Room Temp. Cured Contact Resin Adhesive for Non-Structural Parts

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PROCESS SPECIFICATIONS (Continued)

SECTION II

Number	Title
MA 0201-0018	Pyrotechnic Devices Simulator Modification P/N G16-820541 (Part of Model A14-003) Funct. Test. Proced. for
MA 0201-0025	Hot Bridge Wire Simulator & Decision
MA 0201-0038	Band Radar Transponder, Checkout Unit Funct. Test for
MA 0201-0056	Integrated Sys. Checkout Reqmt's for Boilerplates
MA 0201-0059	Integrated System Checkout Reqmt's for Boilerplate 13
MA 0201-0133	Console Assy., Launch Control Group & Test Conductor, Funct. Test for
MA 0201-0189	L. V. Intermodule Sub Unit, Funct. Test for
MA 0201-0300	Elect. Sys. Insul. Resist. & Continuity Check, Procedure for
MA 0202-0012	Ordnance Installation Procedure Tower/ Command Module Separation System
MA 0203-0017	Boilerplate 13 & 15 Relay Box, Electrical Power Checkout Procedure for
MA 0204-0006	Procedure for Calibration of NASA Type No. 2.11.1.1.2 Amplifiers
MA 0204-0007	Procd. of Calibration of NASA Type No. 2.1.1.0.0 Pressure Transducer
MA 0204-0010	Procedure for Calibration of NASA Type No. 2.8.1.1.0 Linear Accelerometer
MA 0204-0012	Procedure for Calibration of NASA Type No. 2.19.1.2.0 Vibration Measuring System

[redacted]

PROCESS SPECIFICATIONS (Continued)

Number	Title
MA 0205-0001	RF Coaxial Cable RG-115A/U, RG-142/U, RG-142A/U, RG-142B/U Electrical Requirements and Checkout Procedure
MA 0205-0002	Coaxial Cables, RG115/U, RG-115A/U, RG-142/U Checkout Procedure
MA 0205-0011	Boilerplates #13, #15, #16, & #23 Sequencing Box, Elect. Control. Funct. Checkout. and Calibration Procedure for
MA 0205-0012	Boilerplates #9, 13, 15, and 16 - Sequencer Box, Elect. Control, System Funct. Checkout Procedure
MA 0210-0005	Launch Escape System Assembly & Checkout
MA 0302-0002	Procedure for Calibration of NASA Type No. 2.2.7.1.1.1 Pressure System
MA 0302-0003	Ordnance Equipment; Handling, Storage, and Inspection Procedure
MA 0304-0003	Procedure for Calibration of NASA Type No. 11.1.1.3, 2.11.1.1.8 & 2.11.1.1.9 Amplifier, Model 2000D-1
MA 0304-0005	Procedure for Calibration of NASA Type No. 2.7.2.3.1 Pressure Transducers
MA 0304-0008	Procedure for Calibration of ECS Temperature Transducers
MA 0304-0010	Procedure for Calibration of NASA Type Vibration System
MA 0304-0015	Procedure for Calibration of NASA Type No. 2.18.1.1.2, 2.18.1.1.3 & 2.18.1.1.4 Temperature Measuring System

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PROCESS SPECIFICATIONS (Continued)

Number	Title
MA 0305-0001	Coaxial Calbes and Connector Assy. of Bendix Checkout Procedure, Bendix T/-136
MA 0305-0002	Telemetering Transmission Sys. Modulation Package
MA 0308-0002	Alignment & Assembly Procedures for Boilerplate 13 & 15
MA 0308-0014	Ordnance Inst'l - LES TWR. to Command Module Separation System
MA 0310-0004	Handling, Inspection, & Storage of Launch Escape Motor
MA 0310-0005	Handling, Inspection & Storage of Tower Jettison Motor
MA 0310-0006	Handling, Inspection, & Storage of Pitch Control Motor
MA 0406-0001	Pressure Leak Rate Test for Boilerplate Command Modules

CON[redacted]

APPENDIX C
MATERIAL SPECIFICATIONS

1. Scope.- The following constitutes the material specifications applicable to Boilerplate Number 13:

Number	Title
AB0120-007	Resin, Liquid Polymide, Thermosetting
AB0130-021	Silicone Rubber, Room-Temperature Curing (Durometer 40-55)
HB0170-004	Honeycomb, Aluminum 5052- H 39
LB0130-007	Resin, Low-Pressure Laminating, Self-Extinguishing
LB0130-105	Glass-Fabric, Pre-Impregnated, Silicone Resin
LB0130-107	Resin, Low-Pressure Laminating, High-Temperature Polyester Base
LB0130-108	Laminates, Glass-Fabric, High-Temperature Polyester Resin for Structural Use
LB0130-113	Resin, Polyester, Gel-Coat
LB0135-101	Thread, Glass
LB0140-001	Coating, Solid Film Dry Lubricant
LB0140-002	Coating, Solid Dry-Film Lubricant, High-Temperature (700 F Max.)
LB0160-100	Steel, Sheet and Plate, PH17-5Mo, CRES
LB0160-103	Honeycomb, Welded PH15-7Mo or PH14-8Mo, CRES Steel Alloy
LB0160-117	Welding Wire, Corrosion and Moderate Heat Resistant
LB0160-123	PH15-7Mo Bars, Rods and Shapes
LB0160-124	Metals, Identification Marking
LB0160-130	Selected Strength, Close Tolerance PH15-7 Mo, Steel Sheet Strip and Plate Through 1/4"
LB0160-131	Steel Wire, 17-7PH Corrosion Resistant, Spring Temper
LB0160-148	Steel Foil, Corrosion Resistant, Precipitation Hardening
LB0160-165	Steel, Sheet, Strip, and Plate, PH14-8 Mo, Corrosion Resistant, Precipitation Hardening
LB0160-167	Steel, Sheet, Strip, and Plate PH14-8Mo, Corrosion - Resistant, Precipitation - Hardening, Close Tolerance
LB0170-110	Titanium Alloy (6A14V) Bar, Billet, Rings, and Hand Forgings
LB0170-113	Titanium Alloy, Sheet and Plate (6A1-4V)
LB0170-122	Titanium Alloy, (7A1-4Mo) Rod, Bar, and Forgings
LB0170-130	Welding Wire, Corrosion and Heat Resistant, Nickel-Base Alloys
LB0170-139	Titanium Alloy (7A1-4Mo) Closed-Die Forgings
LB0170-147	Titanium Alloy (6A1-4V) Bars, Rods and Shapes, Extruded

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APPENDIX C (Continued)
MATERIAL SPECIFICATIONS

Number	Title
LB0170-160	Brazing Alloy, Low Thermal Conductivity, 80/20 Nickel Matrix
MB0100-003	Substitution of Temper Condition, Form, and Size for Aluminum Alloys
MB0120-008	Adhesive, Low Temperature Curing, Structural
MB0120-013	Adhesive, Elevated Temperature Resistant (300 to 500F) Lightweight
MB0120-014	Adhesive, Elevated Temperature Resistant (300 to 500F) Foaming Type
MB0120-015	Adhesive, Elevated Temperature Resistant (300 to 500F) Lightweight for Honeycomb Sandwich Application
MB0130-001	Silicone Rubber
MB0130-004	Glass-Fabric, Elevated-Temperature-Resistant and Phenolic-Resin Pre-impregnated
MB0130-007	Glass Fabric, Polyester Resin Pre-impregnated
MB0130-001	Molding Compound, Phenolic Resin & Glass Fiber Filled
MB0130-012	Glass Fabric, Epoxy Resin Impregnated for Structura' Applications at Temperatures up to 300F
MB0130-019	Silicone Rubber, Low Temperature Resistant, Room Temperature Curing (Durometer 55-65)
MB0130-022	Rubber-Metallic Gasketing, Oriented Mesh, for RFI Shielding
MB0130-027	Elastomer, Fuel Resistant (71 ± 2 Durometer)
MB0130-028	Elastomers, Space Environment Resistant (65-75 Durometer)
MB0135-010	Insulation, Thermal
MB0135-011	Insulation, Thermal, Molded
MB0135-012	Insulation, Thermal, Fiberon, High Temperature
MB0135-013	Insulation Blanket, Thermal
MB0160-001	Steel, 17-4PH CRES Plate (170,000 Tensile Min)
MB0160-003	Steel, 17-4PH CRES Bar, Extrusions, and Forging
MB0160-007	Tubing, Steel Alloy, Corrosion Resistant, Type 304L
MB0160-008	Welding Rod and Wire, Steel
MB0160-009	Bolts and Screws, Corrosion Resistant, A-286 Alloy
MB0160-013	Steel Castings, 17-4PH Alloy, Corrosion Resistant, Precipitation Hardening
MB0170-002	Aluminum Alloy, 2014 Bare Sheet & Plate
MB0170-003	Weldable Forgings, 2014 Aluminum Alloy, Heat Treated

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APPENDIX C (Continued)
MATERIAL SPECIFICATIONS

Number	Title
MB0170-008	Structural Tubing, 6Al-4V Titanium Alloy Welded, For Apollo Launch Escape Tower
MB0170-010	Weldable Titanium Alloy Ti-5Al-2.5Sn ELI (Extra Low Interstitial) Bar, Billets and Forgings
MB0170-011	Flash Welded Rings, Fabricated From 2014 Aluminum Extruded Bar or Shapes
MB0170-012	Alloy Bar, Forgings, and Forging Stock; Corrosion and Heat Resistant, Nickel Base 18 Cr, 18 Fe, 5 Cb, 3 Mo, 0.8 Ti, 0.6 Al, Consumable Electrode Melted (Inconel 718)
MB0170-013	Solder, Tin-Silver Alloy
MB0170-014	Gold-Copper-Nickel Braze Alloy (81.5 Au - 16.5 Cu-2.0 Ni)
MB0170-016	Aluminum Alloy, 7079-T652 Hand Forgings
MB0170-018	Structural Tubing, 6Al-4V Titanium Alloy, Extruded, for Apollo Launch Escape Tower
MB0170-020	Titanium Alloy (6Al-4V) Forgings for Apollo Pressure Vessels
MB0170-021	Aluminum Alloy, 2014 Bare As-Rolled Plate
RB0170-039	Alloy Sheet, Strip and Plate, Corrosion and Heat Resistant; Nickel Base 18 Cr, 18 Fe, 5 Cb, 3 Mo, 0.8 Ti, 0.6 Al

[redacted]

APPENDIX D

PROCUREMENT SPECIFICATIONS

1. Scope. - The following list constitutes the procurement specifications for Boilerplate Number 13.

Number	Title
MC 111-0004	Bolt Assy. Dual Mode Elect. Initiated
MC 411-0004	Cgl. & Cgl. Spec. Purp. Elect. Apollo G.S.E. Gen. Procur. Spec.
MC 481-0003	R & D Beacon Antenna
MC 481-0026	R & D, UHF Omni Antenna Equipment
MC 901-0002	Rocket Motor, Solid Propellant, Apollo Launch Escape System
MC 901-0014	Test Fixture, Q-Ball
ME 114-0002	Nut, Self-Locking, 12000° F. Reduced Hex (Com'l)
ME 114-0007	Nut, Self-Locking, 500° F. Reduced Hex, Reduced Height, Ring Base, Cres
ME 128-0001	Blind Rivet, Threaded -100° Flat Head
ME 128-0002	Blind Rivet, Threaded - Hex Head
ME 161-0009	Turnbuckle Assembly
ME 181-0035	Console, Electronic Equipment, RFI Shielded
ME 183-0006	Adapter Assy. Launch Escape Motor
ME 281-0005	Pump Assembly - Environmental Systems
ME 284-0069	Valve, Thermal Control
ME 362-0004	Heat Exchanger Assembly, Air Cooling
ME 402-0007	Generator, Pulse
ME 414-0084	Connector Receptacle, Electrical, Umbilical
ME 452-0045	Switch, Motor Driven

APPENDIX E

FLIGHT HARDWARE (NASA Furnished)

Component	Vendor	Vendor No.	EBS Drawing No.	NASA Type No.	Range	Quantity Flt.	Quantity Spare
Telemetry Subcarrier Assembly	Bendix	TATP-316	SD510, 043B / SX530, 135B	3.8.1.1.1		1	None
Commutator	AEC	340-23-5		3.8.1.1.1			
Subcarrier Oscillators	Bendix	TOE-316		3.8.1.1.1			
Matching Amplifier	Bendix	TAA-308		3.8.1.1.1			
Voltage Regulator	Bendix	TRE-315		3.8.1.1.1			
5 Point Voltage Calibrator	Bendix	3132254		3.8.1.1.1			
Telemetry Subcarrier Assembly	Bendix	TATP-316	SD510, 043B / SX530, 097	3.8.1.1.2		2	None
Subcarrier Oscillators	Bendix	TOE-316		3.8.1.1.2			
Matching Amplifier	Bendix	TAA-308		3.8.1.1.2			
Voltage Regulator	Bendix	TRE-315		3.8.1.1.2			
5 Point Voltage Calibrator	Bendix	3132254		3.8.1.1.2			
Q-Ball	Nortronics	F-16A	ME901-0014	22620042	$\pm 40^{\circ}$ 0-1250 PSF	1	1

FLIGHT HARDWARE

Component	Vendor	Vendor No.	EBS Drawing No.	NASA Type No.	Range	Quantity Flt.	Quantity Spare
Telemetry R. F. Assembly A	Bendix	TATP-316	SD510, 044C / SD530, 136A	4. 12. 1. 1. 1	Carrier Frequency 237. 8 MC	1	1
Band Pass Filter	Bendix	TNL-22		4. 12. 1. 1. 1			
R. F. Amplifier	Bendix	TAV-100		4. 12. 1. 1. 1			
Power Supply	Bendix	TPP-118		4. 12. 1. 1. 1			
R. F. Transmitter	Bendix	TXV-100		4. 12. 1. 1. 1			
Telemetry R. F. Assembly B	Bendix	TATP-316	SD510, 044C / SD530, 136A	4. 12. 1. 1. 2	Carrier Frequency 247. 3 MC	1	1
Band Pass Filter	Bendix	TNL-22		4. 12. 1. 1. 2			
R. F. Amplifier	Bendix	TAV-100		4. 12. 1. 1. 2			
Power Supply	Bendix	TPP-118		4. 12. 1. 1. 2			
R. F. Transmitter	Bendix	TXV-100		4. 12. 1. 1. 2			
Telemetry R. F. Assembly C			SD510, 044C / SD530, 136A	4. 12. 1. 1. 3	Carrier Frequency 257. 3 MC	1	1
Band Pass Filter	Bendix	TNL-22		4. 12. 1. 1. 3			
R. F. Amplifier	Bendix	TAV-100		4. 12. 1. 1. 3			
Power Supply	Bendix	TPP-118		4. 12. 1. 1. 3			
R. F. Transmitter	Bendix	TXV-100		4. 12. 1. 1. 3			

FLIGHT HARDWARE

Component	Vendor	Vendor No.	EBS Drawing No.	NASA Type No.	Range	Quantity Flt.	Quantity Spare
C-Band Transponder	Motorda	AN-DPN-66	SC510, 036 SX530, 075	4.4.2.1.1	Carrier Frequency 5690/ 5765 MC	2	1
C-Band Line Filter			SB510, 216 SB530, 237	3.10.1.1.0		2	1
Power Control Box			SD510, 051C SX540, 009	1.5.1.1.1		1	1
Junction Box			SD510, 056B SC530, 013C SB530, 014C	1.8.1.1.1		1	1
Main Battery (120 Amp. Hrs.)	Eagle Picher	MAP-4095-3	SD550, 040A SD550, 040A	1.1.1.3.0		2	2
Pyro Battery (5 Amp. Hrs.)	Eagle Picher	MAR-4090-9	SD550, 041A SD550, 041A	1.1.1.1.0		4	2
Signal Conditioning Box			SD510, 063C SX530, 060A	2.12.1.1.1		1	None
Amplifier Rack (2 Amp./Rack)			SD510, 053D SB530, 111E	5.13.1.1.2		14	2
Amplifier (D. C. Current)	Eng. Mag.	2000D-1	SB510, 060A SD530, 089	2.11.1.1.1	5 cps	1	1
Pressure System			- - - -	2.27.1.1.1	0-15 PSIA	15	
(15) Transducers	Statham	PA-288TC	SD510, 064A SB530, 016	2.7.2.3.1			3
(14) Amplifier	Eng. Mag.	2000D-1	SB510, 060A SD530, 091	2.11.1.1.2	300 cps		2
(1) Amplifier	Eng. Mag.	2000D-1	SB510, 060A SD530, 091	2.11.1.1.6	1000 cps		1

FLIGHT HARDWARE

Component	Vendor	Vendor No.	EBS Drawing No.	NASA Type No.	Range	Quantity Flt.	Quantity Spare
Strain System				2.17.01.00.00	± 4000 Micro in/in	2	
(8) Transducer	BLH	8176	SB510,205 / SB530,172	2.1.1.2.1		8	1
(2) Amplifier	Eng. Mag.	2000D-1	SB510,060A / SD530,090	2.11.1.1.10	300 cps	2	1
(8) Redundant Sensor	BLH	8176	SB510,205 / SB530,172	2.1.1.2.1		8	1
Strain System				2.17.01.00.00	± 1000 Micro in/in	4	
(16) Transducers	BLH	EBD-13	SB510,205 / SB503,172	2.1.1.2.1		16	4
(4) Amplifier	Eng. Mag.	2000D-1	SB510,060A / SD530,090	2.11.1.1.9	100 cps	4	1
(16) Redundant Sensors	BLH	EBD-13D	SB510,205 / SB530,172	2.1.1.2.1		16	
Temperature Systems				2.18.01.01.02		1	
(1) Bridge Adjustment Unit	Microdot	401-0110-1	SD510,083A / SD530,028A	2.13.1.1.2		1	None
(1) Commutator & Amplifier		5D LDA12-N-432	SC510,097 / SB530,074	3.1.2.1.1		1	None
(2) Resistance Thermometers	Transonics	T4082C-8	SC550,000 / SC550,000	2.24.2.3.1	0-150°C	2	1

FLIGHT HARDWARE

Component	Vendor	Vendor No.	EBS Drawing No.	NASA Type No.	Range	Quantity Flt.	Quantity Spare
(8) Resistance Thermometers	Transonics	2168A-2	SB550, 015 SB550, 015	2. 24. 2. 4. 1	0-150°C	8	4
(6) Resistance Thermometers	Transonics	2168A	SB550, 001 SB550, 001	2. 24. 2. 1. 1	0-150°C	6	None
(12) Calori-meters	Hig-Cal	C-1123-A-25-012	SB550, 005 SB550, 005	2. 2. 1. 1. 1	0-25B/F-S	12	4
(8) Calori-meters	Hig-Cal	C-1123-A-5-012	SB550, 004 SB550, 004	2. 2. 1. 1. 2	0-5B/F-S	8	4
(20) Zone Boxes	Microdot	401-0138-1	SC550, 008 SC550, 008	2. 25. 1. 1. 1		20	4
(16) Resistance Thermometer Card	Microdot	401-0123-1	SC530, 068	2. 28. 1. 1. 1	0-150°C	16	4
(20) Thermo-couple Card	Microdot	401-0120-1	SC530, 069	2. 28. 1. 2. 1	0-300°C	20	5
(20) Calori-meter Card			SC530, 070	2. 28. 1. 3. 1		20	5
*Beacon Antenna System			B17-710013 B16-971, 013			1	3
(2) Power Dividers	(Melpar) NAA	ME 481-0003-0002				2	
(4) Antennas	NAA	ME 481-0003-0001				4	
*Telemetry Antenna System			B16-971, 013			1	1
(1) Multiplexer	NAA	ME 481-0026-0002	B16-750013			1	
(1) Filter	(Rantec)NAA	ME447-0013	B16-750013				
(1) Discone Antenna	(Collins) NAA	ME 481-0026-0001	B16-716011			1	

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